Network Hardware

This section deals with the one subject you can literally get your hands around - network hardware. More than any other feature, network hardware may determine the speed, quality and performance of a network. For our purposes, hardware will include hubs, repeaters, bridges, routers, gateways, network interface cards and cabling.

Hubs

A hub is a central connecting device that joins computers in a star configuration. Hubs may be passive or active. A passive hub merely connects computers to the network and does not process data in any way. Active hubs, sometimes called repeaters, regenerate the data in order to maintain signal strength. Some hubs have intelligence and can perform additional duties such as bridging, routing and switching.

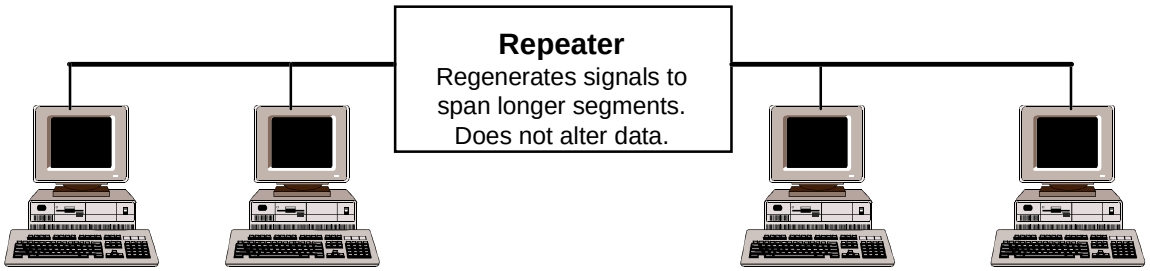
Repeaters, Bridges, and Routers

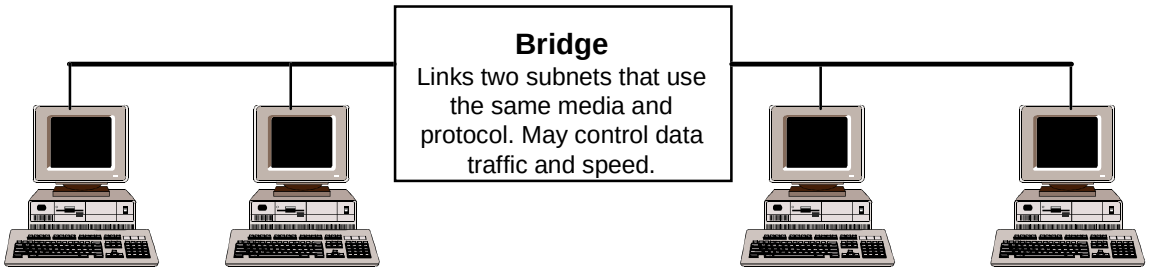
Repeaters, bridges and routers all extend and segment networks. Because of this, they're often confused, as they may take on similar duties. The difference between these devices lies in the different degrees of data discrimination and handling capability.

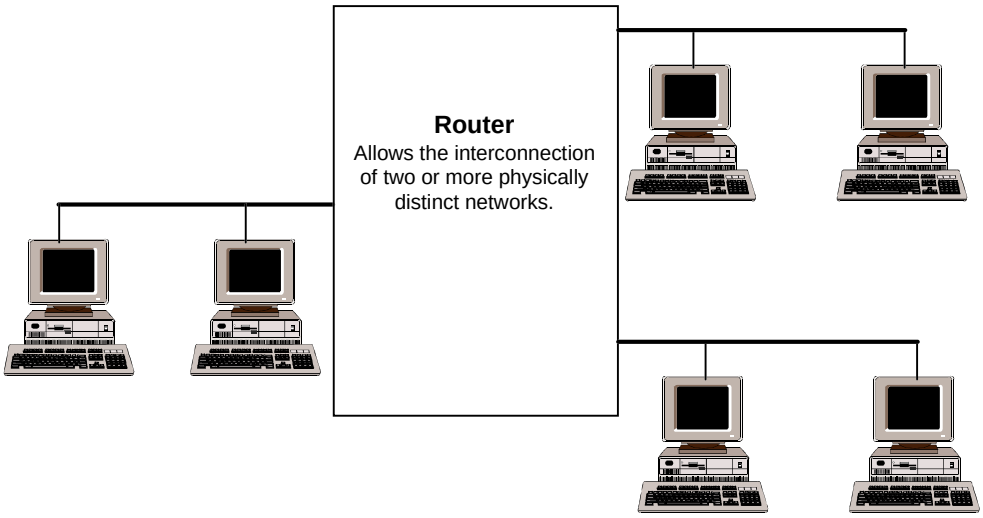
A repeater is the simplest and least expensive of the three. Repeaters are usually small enough to fit in your hand and are used to connect two segments of network cable. The repeater retimes and regenerates signals but does not change the data frame or packet in any way.

A bridge is like a smart repeater. Bridges, like repeaters, can connect two network segments, but bridges are a little smarter about the data they transport. Most bridges have the capacity to listen to the network and figure out the address of each computer on both sides of the bridge. The bridge can then inspect each message that comes from one side and broadcast it to the other side of the bridge, if the message is intended for a computer that is on the other side. This creates a more efficient scheme for data transport.

Routers are like super-intelligent bridges. They can link multiple LANs and look deeper into the data packet to determine its destination. Routers not only know the addresses of the computers on the network but are aware of all the other bridges and routers on the network and can decide the most efficient path in which to send data. When a router receives data, it discards the outer packet or frame, repackages the data, and retransmits the signal. By stripping off the outer layers of data before sending a packet, the total number of bits moving across the network is reduced. The router at the receiving end then repackages the data into a packet of frame that is appropriate for its network.







Functional distinctions between bridges and routers get blurrier as time goes on. Some bridges have advanced intelligence that allows them to take on duties that would normally require a router. These bridges are called brouters.

Gateways

A gateway is like a super-intelligent router. Gateways are designed to connect radically different networks. Although slower than a bridge or router, a gateway has its own processor and memory to perform complex functions such as interpreting between computers that speak different languages through both protocol and bandwidth conversion. A gateway can convert a TCP/IP packet to a NetWare IPX packet and vice versa. An example of a gateway is a messaging gateway, which converts messages between different protocols.

Network Interface Cards

The Network Interface Card (NIC), also known as a LAN adapter, functions as an interface between the computer and the network cabling. Internally the card must buffer the data between the computer and the cable, because the computer is normally much faster than the network. When sending data, the NIC must convert the data from a wide parallel stream into a narrow one-bit-wide stream. On the network side, the NIC must generate the electrical signals that travel over the network, manage access to the network, and make the physical connection to the cable.

Network Cabling

Network cabling comes in many configurations. Common cabling used for networking purposes includes Unshielded Twisted Pair (UT), Coaxial cable, Shielded Twisted Pair (STP), and Fiber Optic cable.

Three key considerations for cabling include the resistance to crosstalk (electrical currents between pairs of wires in the same cable), resistance to outside electrical fields created by electric motors, power lines, relays and transmitters, and the ease of installation. The more resistance a cable has to electrical interference, the longer the cable run can be and the higher the rate at which the data can be transmitted.

Coaxial and Shielded Twisted Pair have a copper braid of foil that offers good resistance to electrical noise, but the extra foil creates a larger, thicker cable, making it difficult to pull the cable through conduit and walls during installation. Unshielded Twisted Pair is thinner and therefore easier to install but offers less resistance to electrical noise.

Because fiber optic cable uses bursts of light instead of electrical pulses, it is impervious to electrical interference. Fiber optic cable carries signals faster and farther than any other type of cable. Unfortunately there is a penalty for all of its speed and strength. A major consideration with fiber optic cable is the specialized training and equipment needed for installation. The additional skills and tools needed make fiber optic cable the most expensive media to install.

Cable Comparisons

Cable	Speed	Cost	Size	Length
Unshielded Twisted Pair	Fast enough	Least expensive	Small	Short
Coaxial	Very fast	Inexpensive	Medium	Medium
Shielded Twisted Pair	Very fast	Expensive	Large	Short
Fiber Optic	Fastest	Most expensive	Small	Very Long

Keys to Remember

- Repeaters regenerate signals to extend the length of the network.
- Bridges can connect two networks and can act as a traffic controller.
- Routers can connect multiple networks and have advanced intelligence enabling it to determine the most efficient method of delivering data.
- Gateways are designed to connect radically different networks.
- Common network media include Unshielded Twisted Pair, Shielded Twisted Pair, Coaxial cable and Fiber Optic Cable